Description

Fibre guide channel

The invention relates to a fibre guide channel for the pneumatic transport of individual fibres according to the preamble of claim 1.

Fibre guide channels of this type are known in connection with open end spinning devices from numerous publications.

DE 195 11 084 A1 describes, for example, an open end spinning device with a fibre band opening mechanism, in which a fibre band temporarily stored in a spinning can, as conventional, is fed to a rotating opening cylinder, which opens the fibre band into individual fibres. The individual fibres are then fed onto a spinning rotor running at a high speed in a rotor housing, via a fibre guide channel, where they are continuously rotated, in an inner rotor groove, onto the end of a yarn leaving the spinning rotor via a withdrawal nozzle. The finished yarn is then wound to form a cross-wound bobbin on an associated winding mechanism.

High demands are placed on the designs of fibre guide channels of this type, in this case, for example with regard to the geometric configuration. In other words, the flow conditions inside the fibre guide channels have to ensure that the fibres are stretched during transport or are at least kept stretched. Moreover, the surface of these components must be continuously smooth, so no fibres attach to the wall during the pneumatic transport. Moreover, harmful air vortexes forming in the

boundary layer region of the fibre guide channels should be avoided as far as possible.

A comparable fibre guide channel is also described in DE 197 12 881 A1. In this known mechanism, the opening cylinder housing is connected pneumatically to the spinning rotor via a multi-part fibre guide channel. This means that the fibre guide channel consists of two separate channel portions, namely a channel portion running inside a so-called fibre guide channel insert and a channel portion arranged in a channel plate adapter. During operation, in other words when the rotor housing is closed, the channel plate adapter, which, apart from the opening region of the fibre guide channel, also has a bore for fixing a thread withdrawal nozzle, extends into the running spinning rotor. It is thus ensured that the opening region of the fibre guide channel is positioned adequately closely to the fibre slide wall of the spinning rotor, so the individual fibres transported in the fibre guide channel are fed according to regulations onto the spinning rotor.

As can be seen from the two patent applications described above, the fibre guide channels have an inlet opening, the width of which is matched to the width of the opening roller mountings. In order to achieve a stretching of the fibres by acceleration of the transport air flow, the free cross-sectional area of fibre guide channels of this type is moreover generally selected in such a way that it decreases in the direction of the outlet opening of the fibre guide channel. The outlet opening, in this case, substantially has a circular cross-section, the minimum diameter of which is predetermined by the air and fibre throughput required during

spinning. The fibres are, in this case, fed onto a relatively wide region of the fibre slide wall of the spinning rotor. Fibres, which are fed onto the fibre slide face in the edge region of the spinning rotor, during their transport to the fibre collecting groove, where they are bound into the thread, are accelerated and further stretched by the rotor rotation and the centrifugal force caused thereby. Fibres, which are fed on near the rotor groove, receive significantly lower stretching, resulting in a different degree of stretching and overall reduced substance utilisation with regard to the specific strength of the yarn produced.

Apart from fibre guide channels with round outlet openings, fibre guide channels with an elongate outlet opening extending substantially in the direction of the rotor periphery are also prior art.

DE-OS 19 39 760 describes, for example, an open end spinning device with a fibre guide channel, which connects an opening cylinder and a spinning rotor. The fibre guide channel, in this case, may have various cross-sectional shapes, for example rectangle, trapezium etc., in particular, also in the region of the outlet opening. In principle, the channel shape from the inlet at the opening cylinder to the opening in the spinning rotor is substantially unchanged. The fibres conveyed in this fibre guide channel, for this reason, are conveyed as far as possible in the position and spread up to the fibre slide face of the spinning rotor in which they arrive from the opening cylinder into the fibre guide channel.

Proceeding from a fibre guide channel of the type described above, the invention is based on the object of developing a

fibre guide channel, which has a shape ensuring a stretching and bundling of the fibres on their way to the fibre slide face.

This object is achieved according to the invention by a fibre guide channel, which has the features described in claim 1.

Advantageous configurations of a fibre guide channel of this type are the subject of the sub-claims.

In the configuration according to the invention, the fibres that have been combed out from the feed fibre band by the opening cylinder are sucked without any problems and virtually completely into the fibre guide channel. There then follows, in a first channel portion, owing to the tapering of the fibre guide channel, an acceleration of the air and fibre flow including an increased fibre stretching and fibre bundling. This bundling takes place predominantly in the plane, in which the greatest width of the slot-shaped inlet opening lies. In this case, the channel cross-section only decreases to the extent that an adequate air throughput is ensured for the spinning process. After a zone which is as far as possible cylindrical in the central region of the fibre guide channel, the cross-sectional shape of the fibre guide channel in turn passes into a slot shape. The main extension of this slot shape, however, is rotated by about 90° relative to the slot shape of the fibre channel inlet.

This angle relates to an imaginary centre line, which also follows a curve of the fibre guide channel. The angle of the section of the fibre guide channel for forming the inlet or

outlet opening thus remains without influence on the claimed angle.

In the above-described manner, viewed in the longitudinal direction of the fibre channel, the projected free cross-section is reduced to the intersecting area between the two slot shapes. This reduced intersecting area is decisive for the fibre bundling, as it becomes effective when the fibres leave the fibre guide channel. Since, despite this bundling of the fibre flow substantially onto said intersecting area, the free cross-section of the fibre guide channel is not reduced to a corresponding degree, the air throughput required can nevertheless be ensured. This result cannot be achieved when an attempt is made to bring about the fibre bundling to a similar degree exclusively by tapering the fibre guide channel, as the required air throughput cannot then be ensured.

The configuration of the fibre guide channel according to the invention moreover ensures that the fibres, during their pneumatic transport from the opening cylinder to the spinning rotor, remain as far as possible without physical contact with the wall of the fibre guide channel and this has a very positive effect overall on the spinning process.

The main extension direction of the outlet opening is oriented approximately parallel to the rotor groove, resulting in a limitation of the fibre feeding to a narrow region. This narrow region ensures fibre feeding onto the rotor slide face such that, in the case of a spaced arrangement with respect to the rotor groove, an adequately long path of the fibres has to

be covered up to the rotor groove, which ensures good drawing of the significant majority of the fibres.

According to claim 2, the cylindrical channel shape is at least approximately circular. Advantages are produced here in terms of flow compared to an oval shape which is also possible according to the invention. In principle, the cylindrical shape can also be understood as slightly conical in order to also maintain a minimum degree of air acceleration in this region.

The curvature of the last channel portion described in claims 3 and 4 is used for the purpose of gradually approaching the fibre flow to the curvature of the fibre slide wall of the spinning rotor. A fibre compression is thus prevented, which could lead to significant strength losses in the finished thread. The curvature is advantageously implemented with the channel widening or flattening. The concentration of the curvature onto the inner wall of the fibre guide channel leads to a concentration of the fibre flow onto the vicinity of the outer wall region of the second channel portion; however, too sharp a deflection of the fibres in the fibre guide channel, which could cause compressions, is above all avoided.

The channel design according to claim 5, ensures maintenance of the air throughput required for the spinning process.

As shown in claim 6, it is provided in an advantageous embodiment that the fibre guide channel is configured in two parts and has a substantially stationarily arranged connection body and a channel plate adapter, which is mounted so as to be easily exchangeable. In this case, a first channel portion

with the slot-like inlet aperture and a preferably round outlet bore are arranged in the connection body, while the channel plate adapter has a second channel portion with a round inlet opening and an also slot-like outlet aperture, which is, however, rotated about the longitudinal axis of the fibre guide channel by about 90°in relation to the inlet opening.

The outlet opening of the first channel portion arranged in the connection body and the inlet opening of the second channel portion arranged in the channel plate adapter are advantageously matched to one another both with respect to their shape and their size. In other words, a uniform transporting air flow with a virtually disruption-free transition of the individual fibres from one channel portion to the other channel portion is provided over the entire length of the fibre guide channel. The exact agreement of the outlet opening of the connection body with the inlet opening of the channel plate adapter also makes it possible that if necessary, for example in the event of a change of batch, the channel plate adapter can be changed without problems.

The transporting air flow inside the fibre guide channel is in no way impaired by a change of this type of the channel plate adapter.

An embodiment of this type leads to a concentration of the fibre flow close to the outer wall region of the second channel portion and therefore to an advantageous bundling of the individual fibres fed on.

It is also provided, in an advantageous embodiment, that the outlet opening of the fibre guide channel is positioned in such a way that when the fibres are fed onto the fibre slide face of the spinning rotor between the feed region and the rotor opening, a fibre-free ring of at least 0.5 mm remains (claim 7). A configuration and arrangement of the outlet opening of the fibre guide channel of this type ensures that virtually all the individual fibres delivered via the fibre guide channel arrive in the rotor groove and contribute to the fibre formation. In other words, the number of fibres unintentionally sucked away via the rotor opening is minimised.

It has proven particular advantageous if the fibre guide channel, as described in claim 8 has an outlet opening, the height of which is between 1.5 mm and 4.5 mm. Such dimensioning of the outlet opening makes an exactly defined depositing of these fibres possible on a region provided for this of the fibre slide face of the spinning rotor.

The invention will be described in more detail hereinafter with the aid of an embodiment shown in the drawings, in which:

Fig. 1 shows a side view of an open end spinning device with a fibre guide channel configured according to the invention,

Fig. 2a to 2c show different views of a connection body of the fibre guide channel, with the first channel portion of the fibre guide channel,

Fig. 3 shows a perspective view of a channel plate adapter, with the second channel portion of the fibre guide channel,

Fig. 4 shows a further view of the channel plate adapter according to Fig. 3,

Fig. 5 shows the fibre guide channel according to the invention in detail and

Fig. 6 shows a section sequence, which is produced along an imaginary centre line of the fibre guide channel.

The open end spinning device 1 shown in Fig. 1 has, as known, a rotor housing 2, in which a spinning rotor 3 runs at a high speed during the spinning operation. In the embodiment shown, the spinning rotor 3 is supported with its rotor shaft 2 in the bearing interstices of a support disc bearing arrangement 4 and is thus fixed in the axial direction by a, for example, permanent magnetic thrust bearing 21.

The drive of the spinning rotor 3 is implemented either, as indicated, via a tangential belt 5, which is placed by means of a support roller on the rotor shaft 22, or by an individual drive. The rotor housing 2 that is open at the front *per se* is connected via a suction line 6 to a vacuum source (not shown), and closed by a so-called fibre channel plate 45 during the spinning operation. The fibre channel plate 45, which is arranged on a cover element 7 which is mounted so it can be rotated to a limited extent about a pivot axis 16, rests with one sealing element 17 on the end face of the rotor housing 2.

A fibre band supply and opening mechanism 8 is integrated into the cover element 7 and comprises *inter alia* a fibre band opening cylinder 9, a fibre band intake cylinder 10 and a

fibre guide channel 11. As shown in Fig. 1, the fibre band opening cylinder 9 running in an opening cylinder housing 23 is driven by a tangential belt 12, for example, while the fibre band intake cylinder 10 is acted upon via a drive shaft extending along the machine or, as indicated, via a single drive 15, preferably a stepping motor.

A receiver 13 that is open in the direction of the spinning rotor 3, is preferably incorporated into the fibre channel plate 45 and has a circular, conically configured contact face, for example.

A so-called channel plate adapter 18 is fixed so as to be easily exchangeable in this receiver 13, so as to be capable of orientation at a precise angle. The channel plate adapter 18, which is shown in Figs. 3 and 4 in enlarged scale, has a central through-bore 14, in which a thread withdrawal nozzle 19 is positioned on the input side and a small thread withdrawal tube 20 is positioned on the output side. Furthermore, a channel portion 11B of the fibre guide channel 11 with the slot-shaped outlet opening 26 and the preferably round inlet opening 31 is furthermore arranged in the channel plate adapter 18.

As indicated in Fig. 1 and shown in more detail in Fig. 5, the opening cylinder housing 23 is continuously pneumatically connected via the fibre guide channel 11 to the rotor housing 2. In other words, individual fibres, which are combed out from a feed fibre band (not shown) by the fibre band supply and opening mechanism 8, are conveyed to the rotor housing 2 via the fibre guide channel 11 and then fed onto the spinning rotor 3 running at a high speed.

As can be seen, in particular from Fig. 5, the fibre guide channel 11 is configured in two parts between its inlet opening 25 and its outlet opening 26. This means that the fibre channel 11 consists of a first fibre guide channel portion 11A and a second fibre guide channel 11B. The first fibre guide channel portion 11A, which has the inlet opening 25, matched to the mountings of the opening cylinder 9, of the fibre guide channel 11, in this case is arranged in a connection body 29, while the second fibre guide channel portion 11B, which ends in the outlet opening 26, is integrated into the channel plate adapter 18.

As shown, both the inlet opening 25 and the outlet opening 26 of the fibre guide channel 11 have a slot-like shape and are arranged rotated with respect to one another by about 90° in relation to the longitudinal axis 28 of the fibre guide channel 11. In other words the maximum extension B of the inlet opening 25 of the fibre guide channel 11 runs parallel to the rotation axis 27 of the opening cylinder 9, while the maximum extension L of the outlet opening 26 of the fibre guide channel 11 is arranged approximately orthogonally with respect to the longitudinal axis 33 of the channel plate adapter 18 and therefore orthogonally with respect to the rotational axis of the spinning rotor 3.

As can be seen, in particular from Figs. 2a to 2c, the channel portion 11A arranged in the connection body 29, has a slot-like inlet opening 25, the large extension B of which runs parallel to the rotational axis 27 of the opening cylinder 9. The free cross-sectional profile of the channel portion 11A ends in a preferably circular outlet opening 32. The outlet

opening 32 is, in this case, matched to the inlet opening 31 of a second channel portion 11B both with respect to its shape and also its size. This second channel portion 11B is integrated into a channel plate adapter 18 and ends, as can be seen in particular from Figs. 3 and 4, in a slot-shaped outlet opening 26. The second channel portion 11B, which has a virtually equally large free cross-sectional area A over its entire length, is, as shown in Fig. 4, slightly curved as a whole toward the longitudinal axis 33 of the channel plate adapter 18.

The wall portion 34 of the channel plate portion 11B adjacent to the longitudinal axis 33 of the channel plate adapter 18 is slightly more sharply curved in this case than the outer wall portion 35, which runs virtually tangentially with respect to the fibre slide face 36 of the spinning rotor 3. The outlet opening 26 of the channel plate portion 11B and therefore also of the fibre guide channel 11 in this case has a height H, which is preferably between 1.5 mm and 4.5 mm. The outlet opening 26 is arranged in this case (see Fig. 5) in such a way that a fibre-free ring 39 is produced on the fibre slide face 36 of the spinning rotor 3, the width of which toward the spinning rotor opening 37 is at least 0.5 mm but preferably significantly wider.

It is to be shown again in Fig. 6 how the cross-sectional area of the fibre guide channel 11 develops from the inlet opening 25 to the outlet opening 26 over a cross-section 31, 32 in a zone Z. In this case, it can be seen that the projected free cross-section 50 is significantly smaller than all the other cross-sections. For this reason, the effective fibre bundling, which takes place substantially up to the projected free

cross-section 50 does not lead to a process-damaging reduction of the cross-sectional area for the air throughput.